

**WHAT IS CLAIMED IS:**

1. A method of phase conjugated vectoring (PCV) of transmission signals propagating via a plurality of twisted pairs of a telephone cable comprising the steps of:
  - 5 propagating a reference signal from a receiver site via one twisted pair of said plurality for obtaining a waveform of PCV reference signal at a transmitter site;
  - establishing PCV antenna bundle for each twisted pair of said plurality;
  - scaling input transmission signals by said PCV reference signal for obtaining mutually coherent PCV transmission signals; and
  - 10 propagating said mutually coherent PCV transmission signals via said PCV antenna bundles for receiving only one signal in a corresponding twisted pair at the receiver site.
2. The method of PCV of transmission signals of claim 1, further comprising measuring a propagation time of said reference signal via said twisted pairs.
- 15 3. The method of PCV of transmission signals of claim 2, wherein each said established PCV antenna bundle comprises a number of the twisted pairs carrying said PCV reference signals above a predetermined power level defined by crosstalk tolerance.
4. The method of PCV of transmission signals of claim 3, wherein the propagation time of  
20 said reference signal does not exceed a shortest wavelength period in any said twisted pair.
5. The method of PCV of transmission signals of claim 3, wherein the propagation time of  
said reference signal exceeds a shortest wavelength period in any said twisted pair.
- 25 6. The method of PCV of transmission signals of claim 5, further comprising the steps of:
  - reconstructing a waveform formed by said referenced signals, which comprises:
    - propagating a plurality of mutually coherent reference signals from the receiver site;

measuring time delay between all twisted pairs of said plurality;  
defining reconstructing parameters by introducing phase delay and amplitude variations between the respective transmission signals at the transmitter site to obtain a plane wavefront at the receiver site; and

5       storing reconstructing parameters in a system memory.

7.      The method of PCV of transmission signals of claim 6, further comprising scaling each said respective transmission signal propagating from the transmitter site by corresponding reconstructing and scaling parameters and funneling each said signal to the PCV antenna bundle.

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8.      A method of crosstalk free transmission of signals through telephone cable having a plurality of twisted pairs between a transmitter site and a receiver site, comprising the steps of:

identifying the telephone cable as a non-uniform physical media;

introducing phase conjugation vectoring (PCV) by propagating one reference signal via one twisted pair of said plurality from the receiver site to the transmitter site, wherein a diverged front of electromagnetic wave presenting said one reference signal is reversed back to the transmitter site to said one twisted pair;

forming a bundle for each twisted pair of said plurality for providing a corresponding phase conjugated vectoring antenna;

20     scaling an input signal by the corresponding reversed reference signal for obtaining scaling parameters of mutually coherent transmission signals; and

propagating simultaneously said mutually coherent transmission signals from the transmitter site via said PCV antenna bundle for obtaining one receiving signal in one said twisted pair at the receiver site.

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9.      The method of crosstalk free transmission of claim 8, further comprising measuring a propagation time of the reference signal via said twisted pairs.

10. The method of crosstalk free transmission of claim 9, wherein the propagation time of any said reference signal does not exceed a shortest wavelength period of a respective electromagnetic wave propagating in any said twisted pair.

5 11. The method of crosstalk free transmission of claim 9, wherein the propagation time of any said reference signal exceeds a shortest wavelength period of a respective electromagnetic wave propagating in any said twisted pair.

10 12. The method of crosstalk free transmission of claim 11, further comprising the steps of:  
propagating a plurality of mutually coherent reference signals from the receiver site;  
measuring distribution of amplitudes and phases of said reference signals at the transmitter site;  
obtaining reconstructing parameters for each twisted pair; and  
scaling the input signal from the transmitter site by said scaling and reconstructing parameters to corresponding reversed reference signal; and  
15 applying said scaled and reconstructed signals to the respective PCV antennas for obtaining one receiving signal in one said twisted pair at the receiver site.

13. A system of crosstalk free transmission of signals via a plurality of twisted pairs of a telephone cable between a transmitter and a receiver sites, comprising:  
20 transmission modems connected to the twisted pairs at the transmitter site,  
said transmission modems comprising combining units for collecting signals from a respective PCV antenna bundle;  
a processing unit coupled with each said combining unit for providing parameters for the PCV antenna bundles for each said twisted pair; and  
25 a PCV components bank coupled to said processing unit for storing parameters of each said PCV antenna, wherein the crosstalk free transmission is provided by scaling input signals to corresponding reversed reference signals and applying scaled signals to the respective PCV antenna bundles.

14. The system of crosstalk free transmission of claim 13, wherein each said transmission modem further comprising:

a buffer/encoder for encoding a transmission input data,

5 IFFT unit connected to said buffer/encoder via said combining unit for obtaining Fourier transformed analog data; and

parallel-to-serial converter connected to said IFFT unit for conversion of analog data into a waveform transmitted in the respective twisted pair.

10 15. The system of crosstalk free transmission of claim 14, wherein the transmission input data is propagated from the transmitter site to the receiver site.

16. The system of crosstalk free transmission of claim 13, wherein each said transmission modem further comprising:

15 a first and a second buffer/encoders for encoding a transmission input data,

IFFT unit connected to said first buffer/encoder via said combining unit for obtaining Fourier transformed analog data;

a first and a second parallel-to-serial converters, said first parallel-to-serial converter connected to said IFFT unit for conversion of analog data into a waveform transmitted in a respective 20 twisted pair;

said second parallel-to-serial converter connected to a NEXT canceling unit via a FFT unit for canceling Near End crosstalk, and

said NEXT canceling unit connected to second buffer/encoder.

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17. The system of crosstalk free transmission of claim 16, wherein the transmission input data is propagated from the transmitter site to the receiver site.

18. The system of crosstalk free transmission of claim 16, wherein the transmission input data is propagated from the receiver site to the transmitter site.

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